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THE  
SINEWS OF WAR

BY  
GEOFFREY CROWTHER  
*Editor of The Economist*

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THIS Pamphlet deals with the two essential constituents of economic strength, Men and Materials. The subject of Money is dealt with in Mr. Crowther's forthcoming Pamphlet in this series on *Wartime Finance*.

The resources of man-power and materials available to the Allies and to Germany are compared, and the conclusion is reached that in almost every respect the Allies have an advantage that is overwhelming. But these advantages can only bring victory if we keep the seas open and defend our factories from air-attack, if we reduce to the minimum our consumption of non-essentials, and if we carry out an energetic and speedy mobilization of our economic resources. 'Time is on our side—if we use it.'

Mr. Crowther became editor of the *Economist* in 1938. He held a Commonwealth Fund Fellowship in the U.S.A. from 1929 to 1931, and visited the U.S.A. again in 1933 on behalf of the *Economist* to study the progress of the Recovery Plan. He is the author of *Economics for Democrats* in Messrs. Nelson's series of 'Discussion Books'.

Throughout this pamphlet figures have been freely used for purposes of illustration or comparison. Few of these are precise quantities; many are no more than approximate, but honest, estimates. More weight should not be put upon them than they can carry.

¶ A list of the Oxford Pamphlets will be found on the back  
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## THE SINEWS OF WAR

### The Economic Aspect of War

**W**AR, nowadays, is an industrial proposition. It is more influenced by the science of economics than by the art of strategy. The present war will not be won on any playing-fields, at Eton or elsewhere, but in the mines and workshops of a thousand grimy industrial towns.

Perhaps this economic aspect of war is not quite so novel a feature of our own times as we like to imagine—Britain's wealth has always helped her to win her wars. But it has certainly never been recognized before the present. It was the chief military lesson of the war of 1914–18.

The pre-1914 organization of a gigantic military machine provided, it is true, for artillery and ammunition. An army must have its arsenals, and if the army was millions strong the arsenals must be gigantic. But the economic demands of a modern army were underestimated, and unprepared for, to a lamentable extent. The General Staffs, for one thing, miscalculated the numbers of weapons that would be required. For example, the machine-gun proved itself the most deadly of all the weapons of the Great War. But the Germans started the war with an allowance of only 16 per battalion, and the British with only 2 per battalion. Moreover, in 1914, the tank was unborn and the airplane still in the cradle. The internal-combustion engine had hardly yet been applied to the business of killing. War stood only at the beginning of its Industrial Revolution, and the soldiers can perhaps be for-

given for not foreseeing how much weight of metal would stand behind each man by the time the war was four years old.

Having failed to foresee the amount of manufacture that would be required to carry on a war the General Staffs naturally failed equally to grasp the importance of raw materials or the deadly effect of blockade. The Germans, as has already been pointed out, supplied their soldiers with more machines than the Allies at the beginning of the war. But the story is told that when Walter Rathenau, one of Germany's leading industrialists, offered his services to the Imperial War Office in August 1914 to help with the task of organizing supplies of essential raw materials, his offer was rejected. Raw materials were not recognized as a problem. Krupp's would have to take on more men and other steel firms might be pressed into service. But that was enough to look after the economic side of war.

The German generals did not have to live long to regret their mistake. The explanation of the 1918 defeat that is fashionable in Germany to-day is that an undefeated army was 'stabbed in the back' by a traitorous crew of Socialists, Republicans, and Jews. But the theory is not true. The German Army was defeated in the field, because its opponents had not only more men, but, man for man, more guns, more shells, more tanks, more aircraft.

### Totalitarian Warfare

The war of 1914 was the first in which Great Powers from the start hurled into the fray all their man-power, recruited by universal service. The

war of 1939 is the first in which the belligerents have realized from the start that it will require all their wealth and productive power.

That war is now fully totalitarian has become a cliché. But it is doubtful whether the full economic consequences have been drawn from the fact, or whether the shifts in the balance of power to which it gives rise have been fully appreciated. It is obvious that the importance in war of having a large and flourishing industry gives some countries a powerful advantage over others. The industrial nations have grown in power compared with agricultural countries. This fact has been most impressively demonstrated since the beginning of the war by the speed and apparent ease with which Germany crushed Poland. The Polish Army was not so much smaller than the German as to explain the rapidity of its collapse. It was defeated neither by superior numbers nor by greater bravery, but by tanks and aircraft—things that only an industrial nation can have in any large numbers. After the Polish campaign of 1939, we can safely say that there is not, as formerly, a steady gradation in military strength from large Powers to small, proportional to population. There is one group of military Powers—those that have strong metallurgical industries—and the rest stand on a distinctly lower plane of strength, as unarmed men facing artillery.

But this is not the only change in the balance of power produced by the new character of war. That new character does not consist merely in a wider use of industry; the essential nature of totalitarian war is that it uses the *whole* of a nation's industry and wealth. And this has produced a somewhat

more subtle change in the balance of power. Not only is the industrial nation placed at a new advantage over the agricultural nation; among the industrial nations themselves, the rich nation has been given an advantage over the poor that it never enjoyed before.

This can be seen from the new disposition of man-power. In 1914 the theory of man-power was that every available man was sent into the army, leaving behind in the arsenals only just enough of the relatively old or disabled to supply the majority in the firing-line itself. It was not only in England that coal-miners and metal-workers were sent into the army in the early days. But by 1918 it had been discovered that every man in the front line needed more than one man in a munitions factory to supply him. The exact figure has been a subject of much debate, and it clearly depends on precisely how the 'front line' and the 'munitions factory' are defined. But if the front line means the combatant army and the munitions factory includes all those working directly or indirectly for the Government, the British figure in 1918 was something of the order of one to three. This process has gone farther since 1918; the volume of equipment of a British division to-day has been stated to be about double what it was at the end of the last war. If so, about five workers at least will be needed at home for every man in the fighting army. It is almost true to say that the 1939 theory of man-power is to put as many men as possible into the munitions factories, leaving in the army only as many men as are needed to drive, manipulate, and fire the weapons. It is almost the opposite of the 1914 theory.

### The Rich Country's Advantage

This change has affected all nations, but in different ways. There is one enormous difference between men in factories and men in trenches. As between the nations of Western Europe, a soldier of one nation is the equal of a soldier of another nation with equivalent training. National romanticism to the contrary notwithstanding, the equation is 1,000 men = 1,000 men. But this is not so as between industrial workers. Some nations are much better equipped with capital than others—that is to say, they have more horse-power of machines to every pair of hands—and the productivity of each worker is therefore greater. To match 1,000 Germans in uniform, 1,000 Englishmen in uniform are needed. But to match the economic output of 1,000 Germans, only about 700 Englishmen are needed.

Clearly, this puts a considerable advantage in the hands of the richer country (i.e. the one with the greater proportion of capital equipment). But still this is not the end of the story. For a nation at war has to do other things besides produce munitions. The first call on its production, in war as in peace, is to provide enough food, clothes, warmth, shelter, and entertainment to keep its people alive and reasonably contented. These necessities can be cut to a minimum, but they cannot be omitted. Only when they have been provided can the country devote what remain of its resources to fighting and making munitions. If, then, we want to measure the strength of a country for economic warfare, we must look, not at the sum total of its economic

resources, but at what is left of them after the bare essentials of living have been provided. This margin above the necessities of life—we can call it the Disposable Margin—is what a nation uses to provide itself with luxuries in peace; it is what it can apply to fighting in war.

The advantage that is thus placed in the hands of Britain, relatively to Germany, can be illustrated by a comparison of the National Incomes of the two countries. (The National Income must not, of course, be confused with the income of the Government. It is the technical name applied to the whole annual output of a country. If a country has a National Income of £1,000 millions, that means that £1,000 millions worth of goods and services are available to be used in a year by the inhabitants of the country and their Government.) In 1937 the National Incomes of Germany and the United Kingdom were of about the same size; probably the British was rather higher.<sup>1</sup> But the minimum needs of twenty million more people had to be met out of the German National Income than out of the British, before any resources could be devoted to luxury, to rearming, or to fighting. Even though the

<sup>1</sup> The net National Income of the United Kingdom in 1937 can be put, on the basis of Mr. Colin Clark's estimates, at £5,200 millions. The official German estimate for that year is Rm. 71,000 millions. It is difficult to know how much, in pounds, Rm. 71,000 millions is. At the 'official' rate of exchange of about Rm. 12 = £1, the figure would be almost £6,000 millions. But this is a wholly artificial figure which has no basis in reality. Many people use the old parity of Rm. 20 = £1, which would give £3,550 millions. Perhaps the 'true' value of the Reichsmark can be put between Rm. 14 and Rm. 16 to the £, giving a figure for the German National Income between £4,500 millions and £5,000 millions.

average German may be ready to put a lower valuation on 'minimum needs' than the average Englishman, it is apparent that Great Britain has a larger 'Disposable Margin', and therefore a larger potential fighting capacity, than the Germany of 1937. And if Germany has grown in size by 50 per cent. since 1937, then the answer is that Great Britain is assisted by Dominions who, in population, and even more in economic potential, increase her strength by at least 50 per cent.—let alone the mighty allied power of France or the resources of the French and British Colonial Empires.

Man-power, in short, has ceased to be the be-all and end-all of military strength. It is only one of a pair—Men and Materials—and even so it has changed its character, since men in the factory now count for more than men in the army. In the remainder of this pamphlet we shall take each in turn and examine the relative strengths of the different combatants.

### Necessity for Economic Mobilization

Before we start on our assessment of Man-power and Material-power, however, a word of caution is necessary. Man-power in the factory needs to be trained just as much as man-power in the trenches. Materials need to be mobilized and wealth to be conscripted. And secondly, a nation cannot apply its 'Disposable Margin' to fighting unless it really succeeds in cutting its consumption of necessities to the irreducible minimum. The argument that has been developed in the preceding paragraphs shows that the rich industrial nation has an enormous *potential* advantage in economic strength.

But to turn his potential advantage into an actual advantage requires that every man and machine that is not needed for maintaining the necessary minimum of existence shall be given a useful war job to do. This is not an impossible assumption. But it requires time for its achievement—and more than time, it needs energetic organization and a loyal willingness to do without whatever is unnecessary and to accept indefinite inconveniences and dislocations.

The subject of economic mobilization for war is too large to be dealt with in this pamphlet. We must take it for granted, after this one warning, that the potential strength of the Allies is in fact mobilized and turned into actuality. Our task is to show how great this potential strength is.

### THE PROBLEM OF MAN-POWER

The advantage in man-power that a relatively rich industrial nation possesses over a relatively poor industrial nation is that the rich nation needs a smaller proportion of its total labour force to supply it with the minimum standard of necessities required to keep the people alive. This is the same thing as saying that it has more workers to spare—either in peace for providing it with luxuries or semi-luxuries above the minimum standard of living, or in war for the dual jobs of fighting and making munitions. It is not an accident that the rich nation is the strong nation; the same cause explains both facts.

In this section, following out the comparison between Great Britain and Germany (but not for-

getting that it is not Great Britain alone that is fighting Germany), we shall explore a little farther this question of 'Man-power to spare'.

### Man-power and the Supply of Food

\*Germany grows the greater part of her food. From the strategic point of view, this is an undoubted advantage. Indeed, Germany could not make war at all if it were not so. There may also be social advantages in having a substantial peasant population. But it is none the less a method of feeding the people that is far more prodigal of man-power than the British method of buying food from overseas in return for manufactured goods. There are two reasons why this should be so. In the first place, by buying from overseas, Britain can draw on the countries where climate, the nature of the soil, and social organization allow food to be grown at a far lower cost than is possible by peasant proprietors in the cold and damp Continent of Europe. And secondly, by paying in manufactures, Britain is invoking the aid of the machine to the fullest extent. The contrast can be shown in figures. In 1935 the agricultural and fishing industries employed, in round figures, 1,400,000 persons in Great Britain. In the same year food and feeding-stuffs to the value of £356 millions was imported. Now in the same year, in British industry as a whole, it took the labour of 1,600,000 persons to produce goods to the value of £356 millions. So if we think of manufactured exports being sold to pay for the imports of food, we can say that about 3 million persons were required to provide the food for 45 million people, or about 6½ persons for every 100

consumers.<sup>1</sup> In Germany the number of persons working on the land in 1933 was 9,200,000, and the number required to make goods for exchange into imported food was about 300,000. The total labour-force required to feed the German people in peace-time is therefore about 9,500,000, or 14½ per 100 consumers. This, clearly, is one way in which Germany is prodigal of man-power. The British system of importing food has certain obvious disadvantages. In particular, it makes the country absolutely dependent on the shipping routes being kept open. This can be perilous in war-time—so perilous that we are now engaged in deliberately increasing the amount of man-power on the land. But if the sea routes *can* be kept open, the system has the great advantage in a totalitarian war of being very economical of man-power. The men that Britain saves by this means can be made available for war. In this way alone, Britain has an advantage over Germany of 8 men in every 100 of the population.

#### • Man-power and the Supply of Raw Materials

Much the same comparison can be drawn relating to raw materials. Neither Germany nor Great Britain is rich in natural raw materials. In fact, both are very poor. Both, as it happens, have more

<sup>1</sup> Most of the calculations in this pamphlet are very approximate. But this one needs a special caution. Actually, part of our imports is paid for not in manufactured goods but in the services of our shipping and insurance industries and other 'invisible exports'. And another part is paid for by the interest on the capital we have invested abroad. If these two considerations could be taken into account, they would lower the estimate of the number of men required to feed the British people. The figure of 6½ must therefore be regarded as a maximum.

coal than they need. Britain has more iron ore than Germany; but neither has enough for its needs. Germany also has potash and magnesite; Britain has a very little tin. But that is all. Great Britain meets her requirements of materials by importing them, and exporting finished manufactures in payment. Germany, in the past, has done likewise. But since the Nazi revolution, the German Government, with its eye on the blockading power of the British Navy, has been doing everything in its power to reduce Germany's dependence on imported raw materials.<sup>1</sup> There are three ways of doing this. The first is to exploit to the full such scanty and neglected reserves of minerals as are to be found in German territory. For example, there are in Brunswick extensive deposits of iron ore. These have been known for some time, but the ore is of such a low grade—that is, there is so little iron to each ton of ore mined—that it has never hitherto paid to mine it. Under Field-Marshal Goering's Four-Year Plan, the expense is being disregarded and the low-grade iron ore is being mined and used. Secondly, it is possible, within limits, to substitute materials that are available for materials that are not. Thus glass can be used instead of porcelain for electric insulators, plastic materials instead of metal for airplane parts, aluminium for copper, &c. And thirdly, some missing raw materials can be replaced by the invention of synthetic chemical substitutes. Germany has gone a long way in this direction in recent years. Thus, petrol is made out of German coal, substitute rubber ('Buna') is

<sup>1</sup> See also Pamphlet No. 4 in this series, *Economic Self-Sufficiency*, by A. G. B. Fisher.

made out of German coal and lime (with the use of prodigious amounts of electricity), staple fibre, which comes ultimately from trees, can be made to take the place of cotton and wool, and so forth.

By these means much can be, and has been, done—though not enough, as will be shown in the next section—to meet all Germany's requirements. But all three methods have this in common: they are very expensive. A ton of pig iron made from low-grade ore costs much more than a ton made from high-grade imported ore. If porcelain is usually preferred to glass for insulators the reason is that glass is either less suitable or more costly. And all the synthetic *ersatz* materials are extremely expensive to make. In England a gallon of petrol made from coal costs about twice as much as a gallon of imported petrol, and the ratio of cost is probably about the same in Germany. In the autumn of 1937, the price of 'Buna', or synthetic rubber, was almost exactly three times that of natural rubber.

If the extra expense of these methods merely meant that they required more money, that would not in itself be an insuperable obstacle. But high cost is merely a reflection of the fact that all these methods are wasteful of labour. Pig iron made from low-grade ore costs more than if it were made from imported ore because more men have to be employed mining the ore (since more tons have to be mined to get a ton of iron content), and more employed mining coal with which to smelt it. Buna costs more than rubber because the number of man-hours of work needed to provide the coal, the

lime, and the electricity out of which it is made is more than the number of man-hours required to produce natural rubber.

So this is a second way in which Germany wastes man-power in order to be self-sufficient. For every hundred tons of rubber Great Britain uses (at the present price) she has expended the labour of something like 45 men for a year. For every hundred tons of Buna that Germany uses she has expended the labour of about 75 men for a year. So that in addition to the extra 8 men that Germany uses to feed every 100 consumers, she also needs more men than Great Britain to provide the industrial raw materials for 100 consumers. It is unfortunately not possible to make an even approximate estimate of the figure. But in war-time, when labour is scarce, it must be a factor of considerable importance. And the more Germany succeeds in making her raw materials at home, the greater will Britain's advantage in man-power become.

### The Margin of Man-power

These advantages exist in peace as well as in war. Indeed, the real meaning of the fact that Great Britain enjoys a higher standard of living than Germany is that we have to employ a smaller proportion of our labour force on providing food and the essential materials. But what happens to the workers that we have to spare because of our more labour-saving methods of procuring food and raw materials? Some of them, unfortunately, remain unemployed. In September 1939 there were said to be only about 100,000 unemployed in Germany, but there were 1,330,000 in Great Britain. But large though this

figure is, it is only 3 in every 100 consumers and does not account for more than a small part of our advantage in man-power; and, of course, most of these unemployed will be directly or indirectly available for war work of some kind. In addition to those who are involuntarily out of work, there are those who choose to seek no employment. This can be seen chiefly among the women. In Germany 49 per cent. of the women in the working ages are actually occupied; in Great Britain only 34 per cent. This, again, is a reserve that we can draw upon in war-time. But the biggest reservoir of labour is to be found in the non-essential trades. As a country's standard of living rises, fewer of its workers are needed to produce the essential minimum, and more can go into making less essential things or providing services. We cannot distinguish in the figures between those who are making essential goods and those who are making luxury goods. But it is possible to illustrate the enormous growth in the industries that do not make things but render services. Between 1921 and 1931 the number of people in England and Wales engaged in the various forms of transport and communication *increased* by 150,000, those working in commerce (including shopkeeping), finance, and insurance by 510,000, in entertainments and sport by 19,000, in personal service by 373,000, and the number of clerks by 378,000. In these four categories alone, then, there was an increase of 1,430,000 in the ten years 1921 to 1931, and although there has been no census since 1931, we can safely say that there are 3 million more people working in these trades in the whole of Great Britain in 1939 than there were in 1921. But the

total population of the country is not very much larger now than it was then and we can get along, if we have to, with the amount of transport, of entertainment, of personal service, and of clerking that we had then. If so, there will be 3 million men and women released for war-work. Germany has no comparable margin of man-power. The number of people in these industries is relatively smaller: transport, commerce, finance, and personal service employed only about 11 people out of every 100 of the population in Germany in 1933, compared with 16 in 100 in England and Wales in 1931. Moreover, the increase in these categories of labour has been far smaller in recent years. The numbers in wholesale and retail trade, finance, and personal service increased between 1921 and 1931 by nearly 700,000 in England and Wales, but by only 170,000 in eight years in Germany.

### Comparison of Man-power in Britain and Germany

We can now make an attempt to summarize the man-power position. In a direct comparison between Great Britain and the 'Old Reich'—that is, Germany within her 1937 frontiers—the position is that Great Britain can spare a number of workers—possibly as many as 10—out of every 100 of the population *more* than Germany can for war-work (which includes, of course, fighting in the armed forces themselves). If the two countries had equal populations, this would mean that the British defence-forces-plus-munitions-industries could be in that proportion larger. But the two countries are not of the same size. Germany, after swallowing Austria, Czechoslovakia, and most of Poland has a

population of about 110 millions. But these German possessions are economically far less strong than Germany herself. There are two reasons for this: first, they are much poorer by nature, especially Poland; and secondly, they will be far less willing workers, especially the Czechs and Poles. On the other hand, the Allied belligerents—Great Britain, France, and the British Dominions—also have a white population of 110 millions, and though France is poorer than Britain, the Dominions, man for man, are richer. If it is borne in mind that we are disregarding the coloured populations of the French and British Empires, it seems quite safe to say that the ratio that applies between Great Britain and the 'Old Reich' also roughly applies between the Allies as a whole and Greater Germany. If so, the man-power we have available for fighting and munition-making combined is several millions larger than Germany's.

Thus we have the men, not only to fight but also to equip those who are fighting—always on the assumption that we are thorough enough in combing out man-power from the less necessary occupations and putting it where it is directly contributing to the war. If we do that thoroughly enough and quickly enough we shall have an overwhelming advantage.

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### RAW MATERIAL SUPPLIES

So much for the men. But industrial warfare cannot be waged with man-power alone. The men must have the materials to work with, and the machinery to work on. In this section we shall very

briefly survey the resources of materials available to the two sides.<sup>1</sup>

The decisive difference between them is that the British Navy is successfully blockading Germany, while the German armed forces have—so far at least—failed to blockade Britain and France. As a result, Germany can trade only with those countries that she can reach without having to cross any water (except the Baltic Sea, which she controls). Great Britain and France, on the other hand, can trade with all the world except only Germany and a few of her eastern neighbours.

### The Financial Position

The Allies' power to import is not quite unrestricted. They must be able to pay for their imports, and they must have ships to transport them. So far as goods from the United States are concerned, the payment must be in cash and the ships must not be American. The normal method of payment for imports is, of course, exports,<sup>2</sup> and Britain and France can both be expected to do what they can to maintain their exports. Indeed, since Germany is prevented from exporting to the greater part of the world, the Allies may be able to seize her markets. In 1938 Germany exported about

<sup>1</sup> We are here concerned only with the comparative positions of the two sides. No attempt will be made to answer the very important question whether Germany will be prevented by the Allied blockade from getting enough materials for her existence, and whether she will consequently collapse. These questions are dealt with in another pamphlet in this series, No. 10, *Can Germany Stand the Strain?* by L. P. Thompson.

<sup>2</sup> Exports must here be considered to include not only 'invisible exports', such as shipping and insurance services, but also the interest on capital invested abroad.

Rm. 2,000 millions, or at least £100 millions, of goods to countries she cannot now reach. If the Allies could take Germany's place in respect of all that trade (though this is unduly optimistic) they would have the means to pay for £100 millions worth of additional imports each year. But it is not always easy for a country at war to maintain an unbroken flow of exports, when labour is short and there is a clamorous demand for munitions. We may, therefore, find that we are buying more than we can pay for in exports. If so, the next most desirable alternative would be to raise credit in the supplying countries. This can be done either by borrowing the necessary money or by persuading the Allies' debtors to repay some of their debts. Or finally, where money can neither be earned by exports nor raised in capital form, we can pay out of our reserves. In 1914 the gold stocks of Great Britain and France were about 50 million ounces; to-day they are about 175 million ounces. In the war of 1914-18, Great Britain sold about £622 millions of its citizens' American and other securities in order to raise dollars. In 1939 British citizens owned well over £200 millions of American securities and a further £1,000 millions of other foreign securities of kinds likely to be saleable in America. The Allies would therefore seem to have the means to make as large purchases from abroad as in the last war—though it may well be that their requirements will be more expensive this time.

#### • Transport •

In shipping, the position is that the United Kingdom, the Dominions, and France have between

them about 940 fewer ships than they had in 1914 (they have 10,208 ships now against 11,148 then), but that the gross tonnage of their ships is about 1½ million tons higher—i.e. the ships are larger, faster, and newer. Moreover, the shipping in the hands of the European neutrals—some, at least, of which can be hired by the Allies—is larger. The number of ships has increased from 4,436 to 6,053 and the gross tonnage has more than doubled, from 6,036,000 tons to 12,337,000 tons.

Both in money and in shipping, then, the means exist for large imports of materials of war to Britain and France. But in neither case are there inexhaustible reserves. It will always be preferable for the Allies to buy goods from countries where payment does not have to be made in the precious dollars and where the distances over which the goods have to be shipped are not great. We can, in fact, draw up an order of preference, and the tables of figures on the following pages have been designed to incorporate it.

### Explanation of the Tables

The most favourable circumstance for Britain and France is to have materials available in their own mother countries. The next is to have them in the self-governing Dominions of the British Commonwealth. The third is to have them in the French and British colonies. In each table, these are the three top lines. Similarly, for Germany, the most favourable circumstance is to have materials in the territory of the old Reich, the next is to have them in one of the newly seized German dependencies. These are the two bottom lines.

The neutrals fall naturally into seven groups—the division being partly political, but mainly geographical. There are four groups of European neutrals. The first is the so-called Oslo States—Scandinavia and the Low Countries. These are all available for trade both to Germany and the Allies (except that Finland has difficulty in trading with the Allies). They are all fairly rich and well-developed countries and all of them (except Switzerland, which is grouped for convenience with the Oslo States) are largely dependent on maritime trade—which makes them very susceptible to the effects of the British blockade. Second is Italy and the Danubian countries, lying to the south and south-east of Germany and normally having very close trading relations with her. Third is Russia and the Baltic States, standing geographically and politically nearer to Germany than to the Allies, but by no means cut off from the West, in either sense. Then, as a transition between Europe and the overseas countries, is the Near Eastern group, consisting of Turkey, Greece, Egypt, Iraq, Iran, Afghanistan, and Arabia. Germany can trade with only the nearest members of this group.

Among the overseas neutrals, the United States deserves a group to herself. The second obvious group is Latin America, with which we will include Spain and Portugal, which fit here more conveniently than elsewhere, since they are overseas to all countries except France. And lastly there is a group which we can call Asia and Africa. Its major constituents are Japan, China, and the Dutch East Indies, but it also includes the Belgian and Portuguese colonies in Africa.

It is, perhaps, easier to fix Germany's order of preference than the Allies'. It is Germany; the German dependencies; then Italy and Danubia (where the payment and transport problems are likely to be least); then Russia; then the Oslo States. (Russia is put in front of the Oslo States because the Allies can also draw supplies from the latter and force Germany to compete for them.) The only other source from which Germany can draw any supplies at all is the Near East.

Among the overseas neutrals, Latin America must come first for the Allies, for though the shipping distance is farther than to the United States, the problem of payment is much easier of solution. Then the United States. And finally Africa and Asia.

This combined order of preference is used in the tables. If the big figures are nearer to the top of the table, the Allies have the advantage. If they are nearer the bottom, Germany has the advantage.

One more preliminary word of explanation is needed. Where the belligerents themselves are concerned, it is their total production of the materials in question that is relevant. Virtually the whole steel production of Britain or Germany can be applied to the war. But this is not so with the neutrals. It is of little importance that the United States or Russia has a big output of steel if most of it is consumed at home. What is relevant to the war is the amount they export. Consequently, the tables show the production figures for belligerents and the export figures for neutrals.

With this preliminary, we can look at the available supplies of the more important categories of

materials. We can start with the coal-iron-steel group which, in spite of all new techniques and synthetic materials, is still the backbone of any industrial system, in peace and even more in war. The figures are shown in Table I.

### Coal, Iron and Steel

In coal, the European belligerents are in approximately equal positions. The United Kingdom and France, on the one hand, and Germany with her conquests on the other, each have a production of about 290 million tons a year. In all probability, this will be enough to meet their requirements and leave some over for export. In iron ore, however, the position is very different. The United Kingdom and France, even without the Dominions and Colonies, have a production more than four times as great as that of Greater Germany. Moreover, the only source from which Germany can import substantial amounts is Sweden (one of the Oslo States), and, to preserve their neutrality, the Swedes will be careful to see that Germany does not monopolize their supply. The Allies have a supply of imported ore from Spain on which Germany cannot draw. In this vitally important material—perhaps the most important of all raw materials—the Allies have a very large advantage over Germany. This is also true of manganese ore, an essential constituent of all high-grade steels. There is much more manganese in the French and British Empires than in Germany or in the States accessible to her. The Russian manganese, Germany's best hope of a supply, is some 1,500 or 2,000 miles away from the German frontier, and even if it

TABLE I. Coal, Iron and Steel

(Figures of total production are in bold type; figures of exports are in *italic* type. All figures are in millions of metric tons and refer, generally, to 1937.)

	<i>Coal*</i>	<i>Iron ore</i>	<i>Manganese ore</i>	<i>Pig iron†</i>	<i>Steel</i>
I. United Kingdom and France . . .	<b>288·9</b>	<b>52·4</b>	—	<b>16·6</b>	<b>21·1</b>
II. British Dominions and India . . .	<b>66·3</b>	<b>6·95</b>	<b>1·70</b>	<b>3·9</b>	<b>3·7</b>
III. British and French Colonial Empires .	<b>2·2</b>	<b>5·7</b>	<b>0·57</b>	—	—
TOTAL ALLIES .	<b>357·4</b>	<b>65·05</b>	<b>2·27</b>	<b>20·5</b>	<b>24·8</b>
IV. Spain, Portugal, and Latin America .	<b>0·2</b>	<b>4·7</b>	<b>0·40</b>	—	—
V. U.S.A. . .	<b>14·2</b>	<b>1·3</b>	—	<b>0·8</b>	<b>0·34</b>
VI. Asia and Africa‡ . .	<b>7·0</b>	<b>2·2</b>	<b>0·12</b>	<b>0·38</b>	<b>0·10</b>
VII. Near East§ . .	<b>0·3</b>	<b>0·3</b>	—	—	—
VIII. Oslo States   . .	<b>11·8</b>	<b>17·5</b>	<b>0·01</b>	<b>0·58</b>	<b>0·47</b>
IX. U.S.S.R. and Baltic States . .	<b>1·2</b>	<b>0·35</b>	<b>1·00</b>	<b>0·14</b>	—
X. Italy and Danubia¶ . .	<b>0·2</b>	<b>0·6</b>	—	<b>0·01</b>	<b>0·02</b>
XI. Czechoslovakia and Poland . .	<b>63·8</b>	<b>2·6</b>	<b>0·11</b>	<b>2·40</b>	<b>3·78</b>
XII. Germany . .	<b>227·7</b>	<b>9·7</b>	—	<b>16·30</b>	<b>20·01</b>
GREATER GERMANY .	<b>291·5</b>	<b>12·3</b>	<b>0·11</b>	<b>18·70</b>	<b>23·79</b>

\* Including lignite in terms of coal. † Including ferro-alloys.

‡ Japan, China, Siam, Dutch East Indies, Belgian Congo, Portuguese Africa. § Greece, Turkey, Egypt, Arabia, Iraq, Iran, Afghanistan.

|| Norway, Sweden, Denmark, Finland, Iceland, Holland, Belgium, Switzerland (N.B. the Dutch and Belgian colonies are included in VI).

¶ Italy and colonies, Hungary, Jugoslavia, Rumania, Bulgaria.

can safely be assumed that Russia will be anxious to help Germany to the utmost extent, the state of the Russian railway system is such that it would be next to impossible to transport large quantities of minerals over these long distances.

The production of pig-iron and steel depends

upon the number of blast furnaces in a country, not upon the amount of iron ore or coal produced in that country. The position of the two sides is therefore more equal. Greater Germany produces rather more of both pig-iron and steel than the United Kingdom and France alone, but rather less of each than the whole British and French Empires. The Allies also have the advantage in imports, since they can draw, in case of need, on the whole export surplus of the United States, while the only substantial source accessible to Germany is in the Oslo States, whose exports she would have to share with the Allies.

To sum up this group: Germany is at a slight disadvantage in supplies of coal and in the amount of steel-producing capacity. She is at a serious disadvantage in iron ore. And since iron ore is an essential constituent of steel, it follows that, in a long war, she might find herself able to make very much less steel than her opponents.

### Non-ferrous Metals

The second important group of materials is composed of the non-ferrous metals—i.e. those other than iron—of which figures for the five most important are shown in Table 2.

In reading this table, it should be borne in mind that all five are not of equal importance in time of war. Copper is essential for shell cases, and almost essential for electrical equipment. Nickel is needed for making the hard steels so much needed in war. Lead is wanted for bullets. Zinc and tin are less necessary for ammunition, though, of course, as important industrial materials, they play as large a

TABLE 2. *Non-ferrous Metals*

(Figures of total production are in bold type; figures of exports are in italic type. All figures refer not to the gross weight of metal but to the estimated metal content. They are in *thousands* of metric tons and refer, generally, to 1937.)

	<i>Copper</i>	<i>Lead</i>	<i>Zinc</i>	<i>Tin</i>	<i>Nickel</i>
I. United Kingdom and France . . .	—	<b>30</b>	<b>10</b>	—	—
II. British Dominions and India . . .	<b>300</b>	<b>480</b>	<b>440</b>	—	<b>100</b>
III. British and French Colonial Empires . . .	<b>280</b>	<b>130</b>	<b>100</b>	<b>100</b>	<b>10</b>
TOTAL ALLIES . . .	<b>580</b>	<b>640</b>	<b>550</b>	<b>100</b>	<b>110</b>
IV. Spain, Portugal, and Latin America . . .	<i>520</i>	<i>300</i>	<i>200</i>	<i>30</i>	—
V. U.S.A. . . .	<i>270</i>	<i>20</i>	<i>10</i>	—	—
VI. Asia and Africa* . . .	<i>170</i>	<i>10</i>	—	<i>70</i>	—
VII. Near East* . . .	—	<i>10</i>	<i>10</i>	—	—
VIII. Oslo States* . . .	<i>30</i>	<i>10</i>	<i>30</i>	—	—
IX. U.S.S.R. and Baltic States . . .	—	—	—	—	—
X. Italy and Danubia* . . .	<i>30</i>	<i>40</i>	<i>80</i>	—	—
XI. Czechoslovakia and Poland . . .	—	<i>10</i>	<i>80</i>	—	—
XII. Germany . . .	<b>30</b>	<b>90</b>	<b>180</b>	—	—
GREATER GERMANY . . .	<b>30</b>	<b>100</b>	<b>260</b>	—	—

\* See notes to Table 1.

part in the war economy as in peace-time. In particular, there is no satisfactory substitute for tin in making food tins, or for zinc in making corrugated sheets—both of them much needed in war-time. It can be seen from the table that the Allies have a very large advantage in all five metals. And it so happens that the metal, zinc, in which Germany's disadvantage is least is also the least necessary of the

five. It is only fair to add that Germany has made special efforts to ensure an adequate supply of aluminium, which, in addition to valuable properties of its own, can to a certain extent replace copper in some of its uses. But this does not offset the fact that Germany's supplies of the important non-ferrous metals are very much inferior to those available to the Allies.

### Textiles

Table 3 shows the position in four of the most important textile materials.

Cotton and wool are by far the most important of these. Germany's disadvantage is clearly overwhelming—particularly so as the Russian supply of cotton is thousands of miles away in Central Asia. Jute, whose war uses (sandbags) are not to be despised, is almost a monopoly of the Allies. In flax, on the other hand, Germany has a decided advantage. Her own production is larger than the Allies', and the neutral sources are to be found in the Baltic region where trade with the Allies is difficult. This, however, is less important than it was in the last war, since the chief war use of flax, to make fabric for airplane wings, has disappeared in the development of aircraft technique; wings are now almost always made of metal. In this group too, then, we can conclude that Germany has far smaller resources at her disposal than the nations she has challenged.

### Petroleum and Rubber

The final raw material table deals with petroleum and rubber, two commodities which can be grouped

TABLE 3. *Textiles*

(Figures of total production are in bold type; figures of exports are in *italic* type. All figures are in *thousands* of metric tons and refer, generally, to 1937.)

	Cotton	Wool	Flax	Jute
I. United Kingdom and France . . .	—	<b>70</b>	<b>30</b>	—
II. British Dominions and India . . .	<b>1,040</b>	<b>770</b>	—	<b>1,510</b>
III. British and French Colonial Empires .	<b>180</b>	<b>50</b>	—	—
TOTAL ALLIES . . .	<b>1,220</b>	<b>890</b>	<b>30</b>	<b>1,510</b>
IV. Spain, Portugal, and Latin America . . .	<i>380</i>	<i>200</i>	—	—
V. U.S.A. . . .	<i>1,240</i>	—	—	—
VI. Asia and Africa* . . .	<i>140</i>	<i>10</i>	—	<i>20</i>
VII. Near East* . . .	<i>410</i>	<i>30</i>	—	—
VIII. Oslo States* . . .	—	<i>40</i>	<i>120</i>	<i>10</i>
IX. U.S.S.R. and Baltic States . . .	<i>190</i>	—	<i>80</i>	—
X. Italy and Danubia* . . .	—	—	<i>20</i>	—
XI. Czechoslovakia and Poland . . .	—	<i>10</i>	<i>50</i>	—
XII. Germany . . .	—	<i>20</i>	<i>30</i>	—
GREATER GERMANY . . .	—	<b>30</b>	<b>80</b>	—

\* See notes to Table 1.

together partly because neither fits into one of the earlier groups and partly because both find their chief market in the automobile industry. The figures are in Table 4.

Once again, there is an overwhelming advantage on the Allied side. This would be less if it were possible to quote accurate figures for the production of oil-from-coal and of synthetic rubber in Germany. But the figures are certainly not large

TABLE 4. *Petroleum and Rubber*

(Figures of total production are in bold type; figures of exports are in *italic* type. All figures are in *thousands* of metric tons and refer generally to 1937.)

	<i>Petroleum</i>	<i>Natural rubber†</i>
I. United Kingdom and France . . . . .	<b>70</b>	—
II. British Dominions and India . . . . .	<b>670</b>	<b>10</b>
III. British and French Colonial Empires . . . . .	<b>5,140</b>	<b>570</b>
<b>TOTAL ALLIES . . . . .</b>	<b>5,880</b>	<b>580</b>
IV. Spain, Portugal, and Latin America . . . . .	<i>30,000</i>	<i>20</i>
V. U.S.A. . . . .	<i>22,000</i>	—
VI. Asia and Africa* . . . . .	<i>5,700</i>	<i>400</i>
VII. Near East* . . . . .	<i>13,300</i>	—
VIII. Oslo States* . . . . .	—	—
IX. U.S.S.R. and Baltic States . . . . .	<i>1,800</i>	—
X. Italy and Danubia* . . . . .	<i>5,700</i>	—
XI. Czechoslovakia and Poland‡ . . . . .	<b>20</b>	—
XII. Germany . . . . .	<b>480</b>	—
<b>GREATER GERMANY . . . . .</b>	<b>500</b>	—

\* See Notes to Table 1.

† These figures exclude the production of synthetic rubber, on which no accurate figures are available.

‡ Excluding territory annexed to U.S.S.R.

enough to close more than a fraction of the gap between the Allies and Germany. The production of oil-from-coal in Germany is probably now about 1,500,000 tons per annum, and the production of 'Buna' may be as much as 70,000 tons per annum.

This outline analysis of the available supplies of war materials has, of course, omitted a number of less important materials. In some of these—potash and magnesite, for example—Germany has a large

part of the world's total production. But it would be an unnecessary labour to go through them all—for two reasons: first, because the minor materials are far less important than those that have been selected for analysis; and, secondly, because the general story is monotonously the same for the minor as for the major materials—enormous supplies on the Allied side, shortage on the German side. German energy and ingenuity has done a great deal to create artificial supplies of some materials,<sup>1</sup> but all these back-door methods are expensive and their combined effect does not alter the fact that Germany will be extremely short of almost all essential materials after the stocks with which she started the war have been exhausted.

### Conclusion

The task of this pamphlet was to compare the resources of man-power and materials available to us and to the enemy. That task has now been discharged, and it has been proved that in almost every respect we have an advantage that is overwhelming. We have more men to spare for fighting and munition-making, and we have more materials for them to work with. Does this prove that we shall win the war? It does not. It proves that we *can* win the war if we do certain things; and it is essential to set out these vital conditions once again. They are five in number.

1. We must keep the seas open to our trade while closing them to the enemy.
2. We must prevent the enemy from overrunning

<sup>1</sup> Reference may again be made to Mr. L. P. Thompson's pamphlet in this series, *Can Germany Stand the Strain?* . . .











